0.1	Tunnel name		Hvalfjörður				
0.2	Country		IS				
0.3	Name of Road		1				
0.3-a	Tunnel located near / in (city)		Akranes				
0.3-b	Road from ... to ...		Highway 1 goes around Iceland				
0.3-c	Between motorway junctions		Akranes - Kjalarnes				
0.4	Type of road		rural				
0.5	Tunnel opened to traffic in (year)		1998				
0.6	Operator		Spölur ehf				
0.7	Internet adress		marino@spolur.is				
0.8	Toll tunnel		yes				
	Statistics		**data**	**basic year**			
S.1	Breakdowns per year		26	2009			
S.2	Accidents per year		8	2009			
S.3	Fires per year		0	2009			
	Risk potential		**data**	**basic year**		**max. points**	**assessment**
R.1	Length	m	5770				4
R.2	AADT - unidirectional traffic	veh/d	-	-			0
							0
	AADT - bidirectional traffic	veh/d	5400	2009			2
							0
R.2-a	Traffic performance	Mio veh*km	14,5				
	Traffic volume	veh/d,lane	2700			5	1
R.3	Percentage of HGV	%	5,00	2009			3
							0
	Traffic performance of HGV per tube and day	HGV*km/d	1558				
R.4	Maximal longitudinal slope	%	8,1			3	3
R.5	Type of traffic		bidirectional				
R.6	Transport of dangerous goods		B			5	1
		transports/d	8				
R.7	Additional risk		1			3	1
					0,80	**medium**	**15**
	Safety potential		**data**	**requirement (max - min)**		**max. points**	**assessment**
1.1	Number of tubes		1				
1.1-a	Number of tubes per driving direction		0,5	≥ 1		50	0
1.2-a	Number of traffic lanes per tube		2				
1.2-b	Traffic lane width	m	3,4	3,50	2,50	40	36
1.2-c	Same number of lanes inside and outside the tunnel		1			20	20
1.3-a	Emergency lane provided		0			10	0
1.3-b	Emergency lane width	m	-	2,50	1,00	40	0
1.3-c	Headroom of emergency lane	m	-	4,50		10	0
1.4-a	Lay-bys provided		1				
1.4-b	Distance between lay-bys	m	500	600	1400	40	36
1.4-c	Lay-bys arranged opposite each other		0			10	0
1.4-d	Length of lay-bys	m	18,5				
1.4-e	Width of lay-bys	m	3,20				
	Area of lay-bys	m²	59,2	100	50	10	1,84
1.5-a	Emergency walkways on both sides		1			5	5
1.5-b	Width of emergency walkways	m	0,7	1,00	0,5	10	2
1.5-c	Emergency walkways elevated		1			5	5
1.7	Altitude of tunnel portal 1	m asl	10				
	Altitude of tunnel portal 2	m asl	20				
1.9	Light paint of tunnel walls		0			10	0
	Additional measures					35	35
1.6-a/b	Rumble strips in front of the portals		1			5	5
1.6-d	Crash cusion at the portals		1			10	10
1.8-a	Road surface of a light colour		0			5	0
1.8-b	Road surface free of defects		1			10	10
1.10	No long straight stretch of road before tunnel exit		1			10	10
1.11	Tunnel dry		1			10	10
1.12	Measures against flooding		0			5	0
	Tunnel system					**235**	**140,8**
2.1	Illumination throughout the tunnel		1			10	10
2.2	Adaptation lighting provided		1			10	10
2.3	Luminance in the area of lanes (at day)	cd/m²	1,3	6	0	20	4,3
2.6	Emergency lighting		1			10	10
2.7	Energy supply (looped or two independent wiring systems)		0			20	0
2.8	Energy supply possible in case of local failure		0			20	0
2.9	System for emergency power supply (UPS) available		1			5	5
2.9-a	Operation duration of UPS	min	60	60	0	10	10
2.9-b	Maintain supplies without a break		1			10	10
	Additional measures					10	10
2.3-a	Valuation of illumination - brightness of tunnel		0			5	0
2.3-b	Valuation of illumination - specular surfaces		1			5	5
2.3-c	Valuation of illumination - evenly illumination of road surface		0			5	0

2.4	Lights clean and operational		1			5	5
2.5	Accentuated lay-by lighting		1			5	5
	Lighting/ Power supply					**125**	**69,3**
3.1	Congestion inside the tunnel rarely		1			20	20
3.3	No overtaking		general				
3.5	Speed limit	km/h	70	50	130	10	7,5
3.5-a	Speed limit inside the tunnel		1				
3.6	Dangerous goods transport prohibited		0			20	0
3.6-a/b	*Restrictions for dangerous goods transport*		1			*5*	5
3.6-d	*Report to control station for dangerous goods transport*		0			*5*	0
3.7-a	Control station available		1			10	10
3.7-b	Control station is continuously staffed		1			10	10
3.7-c	Conrol station staffed with trained personnel		1			15	15
3.8	Complete supervision of total tunnel possible		0			10	0
3.9	Distance between video cameras	m	525	50	350	20	0,0
3.10	Automatic data recording (video system) in case of emergency		0			10	0
3.11	Automatic incident detection (AID)		0			20	0
3.12	Automatic traffic control		1			10	10
3.13	Automatic congestion identification		0			5	0
3.13-a	Time needed for automatic congestion identificati	min	-	0,5	10	10	0,0
3.18	Automatic traffic management before the tunnel		0			10	0
3.19-a	Tunnel closure with traffic lights before tunnel portals		1			10	10
3.19-b	Tunnel closure with traffic lights inside the tunnel	m	-	300	1200	10	0,0
3.19-c	Physical barriers before the tunnel provided		1			10	10
3.20	Additional information in case of tunnel closure		1			10	10
3.21-a	Tunnel sign		1			5	5
3.21-b	Sign to indicate lay-bys		1			5	5
3.21-c	Sign to indicate speed limit		1			5	5
3-21-d	Signposting minimum distances between vehicles		1			5	5
3.21-e	Signs for detour/bypass route available		0			5	0
3.22-a	Near side carriageway edge marked		0			10	0
3.22-d	Lane separation with roads reflectors		1			10	10
	Additional measures					25	25
3.2	Tunnel not congested during holiday season or at weekends		1			5	5
3.4	Specific measures for heavy goods vehicles		0			10	0
3.14	Automatic detection of dangerous goods vehicles		0			5	0
3.15	Monitoring of minimum distances / speed		1			5	5
3.16	Automatic report, if lay-by/ emergency lane is used		0			5	0
3.17	Height check before entering the tunnel		1			10	10
3.19-d	Physical barriers inside the tunnel provided		0			5	0
3.21-f	Variable message signs inside the tunnel		0			5	0
3.21-g	Clean signs		1			5	5
3.22-c	Road marking o.k.		1			5	5
	Traffic and traffic control					**290**	**162,5**
4.1-a	Loudspeakers at portals provided		0			5	0
4.1-b	Loudspeakers inside tunnel e.g.at lay-bys, emergency exits		0			5	0
4.1-c	Loudspeakers in the area of shelters, refuges and exits		0			10	0
4.2-a	Traffic radio throughout the tunnel		1			20	20
4.2-b	Number of traffic radio stations		3				
4.2-d	Information on traffic radio (at tunnel entry)		1			5	5
4.2-f	Reports can be fed into radio programs		1			10	10
4.3-a	Emergency phones installed in each direction		1			5	5
4.3-b	Distance between emergency phones	m	500	50	350	20	0,0
4.3-d	Emerency phones - marking		1			10	10
4.3-e	Emergency phones - UPS & paint signposting		1			5	5
4.3-f	Sound-insulated emergency phones		0			10	0
4.3-h	Emergency phones at tunnel portals		1			5	5
4.3-i	Emergency phones fully functional		1			10	10
4.4-a	Emergency phones - signal activated upon use		0			5	0
4.4-b	Emergency phones - automatic video monitoring		0			10	0
4.5-a	radio communication for operational staff		1			10	10
4.5-b	radio communication for fire brigade		1			10	10
4.5-c	radio communication for police		1			10	10
	Additional measures					15	10
4.2-e	Reports can be fed into all available traffic radio programs		1			5	5
4.2-g	Multilingual reports		0			5	0
4.2-h	Information on traffic radio stations/ frequencies displayed inside		0			5	0
4.2-i	Reports separated concerning traffic direction		1			5	5
4.4-c	Emergency phones - automatic speed reduction		0			5	0
4.6	Mobile telephone system available		0			5	0
4.7	Communication in foreign languages		0			5	0

	Communication					**180**	**110,0**
5.1	Additional escape routes available		none				
5.2-a	Distance between emergency exits	m	-	100	1000	100	0,0
5.2-b	Emergency exits - Signposting sufficient		-			10	0
5.2-c	Emergency exits - UPS/ paint signposting		-			5	0
5.2-d	Fire resistance of escape doors at least T90		-			5	0
5.2-j	Improve escape and rescue conditions by reducing temperature		-			30	0
5.3-a	Escape routes protected against smoke intrusion		-			5	0
5.3-c	Escape routes clearly marked		1			5	5
5.3-d	Distance between marking of escape route	m	1000	25	100	15	0,0
5.3-e	Emergency lighting of escape route inside the tunnel		0			5	0
5.3-f	Distance between emergency lights	m	-	10	80	15	0,0
5.3-g	Emergency lights - UPS available		-			5	0
5.3-j	External escape routes safe and illuminated		-			5	0
5.4	Access for rescue personnel from outside		0			5	0
5.4-a	Distance of vehicle usable rescue ways	m	-	500	2500	15	0,0
5.6	Turning is possible for passenger cars		1			5	5
5.7	Turning is possible for HGVs		1			5	5
5.8	Crossing possible in front of portals (in case of unidirectional tra		1			10	10
	Additional measures					15	0
5.2-e	Special lighting of emergency exits		-			5	0
5.2-h	Separate pressurised ventilation systems for escape routes/cha		-			5	0
5.3-b	Escape route suitable for disabled people		-			5	0
5.3-i	Escape route signed behind emergency exit		-			5	0
5.3-k	Emergency behaviour instruction signs		0			5	0
5.5	Shelter (without second exit) available		0	≤ 500		10	0
	Escape and rescue routes					**230**	**25,0**
6.1	Tunnel walls fire protected (protection against spalling)		1			10	10
6.3	Fire protection cables		0			10	0
6.4-b	Distance between fire extinguishers	m	250	50	350	20	6,7
6.4-e	Servicing fire extinguishers okay		1			10	10
6.5-a	Fire extinguishers - signal automaticly activated upon using		0			5	0
6.5-b	Fire extinguishers - CCTV (video)		0			10	0
6.6	Fire detection system based on heat detection		0			10	0
6.6-b	Distance of sensors	m	-	5	50	20	0,0
6.6-c	Automatic detection of fire location		0			10	0
6.8	Manual fire alarm system available		0			10	0
6.9-b	Pressurised fire-fighting water supply throughout the tunnel		1			5	5
6.9-d	Flow rate	l/s	33	30	10	10	10,0
6.9-e	Supply of fire water	m^3	150	250	20	10	5,7
6.10-a	Distance between hydrants	m	2800	50	350	20	0,0
6.10-c	Hydrants at tunnel portals		1			5	5
6.11-a	Drainage system to dispose of combustible or toxic liquids		0				0
6.11-c	Drainage system -distance of siphons	m	-	25	150	20	0,0
6.11-d	Drainage system -maximum capacity (flow rate)	l/s	-	200	50	10	0,0
6.11-e	Storage capacity (of reservoir) for liquids and fire-	m^3	-	250	30	10	0,0
6.12-b/e	Distance to be covered by fire brigade	km	28				
6.12-c/f	Time period within the fire brigade can reach the p	min	25	5	20	20	0,0
6.12-h	Training of fire brigade inside the tunnel at regula	month	-	12	60	10	0,0
6.12-j	Fire brigade - fire trucks		1			10	10
6.12-k	Fire brigade - extraction equipment to free injured passengers tr		1			5	5
6.12-l	Fire brigade - heat image camera		1			5	5
6.12-m	Fire brigade - capacity of cardiovascular/ respirato	h	0,5	2	0,5	10	0,0
	Improve fire-fighting conditions for fire brigade by						
6.12-q	limitation of fire site		-			20	0
	Additional measures					40	5
6.2	Tunnel walls especially fire protected (against collapse)		0			10	0
6.5-c	Fire extinguishers - tunnel closure		0			5	0
6.7	Early fire detection system available		0			10	0
6.7-b	Thermal imaging cameras at portals		0			10	0
6.9-f	Fire-fighting water is supplied from both tunnel ends		1			5	5
6.12-i	Fire brigade - trained under real-life conditions		0			5	0
6.12-n	Other supply of fire-fighting water		-			10	0
6.13	Hose reel system for fire fighting		0			10	0
6.14-e	Activation criteria for fire suppression system		0			5	0

6.14-i/j	Functionality tests of frie suppression system		0			5	0
	Fire protection					**315**	**77,3**
7.1	Mechanical ventilation for dilution of vehicle emissions		1			10	10
7.2	Automatic control of ventilation under normal conditions		1			5	5
7.5	Special fire ventilation programs		0			10	0
7.6	Supervision of the longitudinal flow		LL			10	5
7.7	Longitudinal flow is considered for control of ventilation		0			5	0
7.8/9	Temperature resistance of ventilation equipment		1			20	20
7.10-a	System tested in fire behaviour test		0			10	0
7.10-b	System checked on base of air flow measurements and smoke		1			10	10
7.11-d	Prevention of smoke intrusion into neighbouring tube		1			10	10
7.12	Ventilation system in case of fire		longitudinal				
7.12-a	Number of ventilation sections		1				
7.13-a	Length of ventilation sections	m	5770	500	4500	40	0,0
7.13-b	Maximum achievable air speed	m/s	2,5	3,5	1	20	12,0
7.13-d	Air movement in the direction of traffic		0			30	0
7.13-e	Steam direction of fans reversible		1			10	10
7.14-a	*Flow rate of smoke extraction*	*m³/s*	-	*150*	*50*	*40*	0,0
7.14-b	*Steering of longitudinal air flow possible*		-			*10*	0
7.14-c	*No flow reversal required to extract smoke*		-			*10*	0
7.14-d	*Opening of flaps near the fire site*		-			*10*	0
7.14-e	*Closing of flaps outside the fire zone*		-			*30*	0
	Ventilation					**190**	**82,0**
8.1-a	Fire alarm plan and rescue operation plan		1				
8.1-b	# schema/ procedure for alerting		1			10	10
8.1-c	# alternative itineraries		1			5	5
8.1-d	# emergency instructions for operational staff		1			10	10
8.1-e	# schema/ procedure for analysis of important incidents/ accide		0			5	0
8.1-f	# special measures for disabled people		0			5	0
8.1-g	Fire alarm and rescue operation plan actual		0			10	0
8.2-a	Automatic activation of fire ventilation		semi-automati	automatic	semi-automatic	10	0
8.2-b	Automatic tunnel closure in case of fire		semi-automati	automatic	semi-automatic	10	5
8.2-c	Automatic activation of alarm for fire brigade		semi-automati	automatic	semi-automatic	10	5
8.3-d	Safety measures in case of accident		sufficient	good	sufficient	10	5
8.4-d	Safety measures in case of car fire		sufficient	good	sufficient	10	5
8.5-a	Emergency exercises carried at regular intervals	month	-	12	60	10	0,0
8.5-b	# documentary proof		-			5	0
8.6	Training for personnel at regular intervals		0			10	0
8.6-b	# documentary proof		-			5	0
8.7	Regular internal check of safety facilities/ maintenance schedul		1			5	5
	Emergency management					**130**	**50,0**
	Evaluation of safety potential						
	1. Tunnel system		acceptable		75	235	140,8
	2. Lighting/ Power supply		poor		69	125	69,3
	3. Traffic and traffic control		acceptable		70	290	162,5
	4. Communikation		acceptable		76	180	110,0
	5. Escape and rescue routes		very poor		14	230	25,0
	6. Fire protection		very poor		31	315	77,3
	7. Ventilation		very poor		54	190	82,0
	8. Emergency management		very poor		48	130	50,0
	Total - Points		**very poor**		**52,9**	**1695**	**717,0**
	Evaluation of K.O criteria			**prevention**	**detection**	**self rescue**	**reaction**
	1. Tunnel system	13,9	0,0	0,0			
	2. Lighting/ Power supply	7,4	0,0	0,0			
	3. Traffic and traffic control	17,1	0,0	0,0	0,0		0,0
	4. Communikation	10,6	0,0				0,0
	5. Escape and rescue routes	13,6	7,8			15,5	
	6. Fire protection	18,6	7,6		3,8		6,9
	7. Ventilation	11,2	2,2			4,3	
	8. Emergency management	7,7	1,9				3,4
	Total - K.O. criteria value	**34,0**		0,0	3,8	19,8	10,3
	Total - Assessment		**very poor**				